

BRIEFER ARTICLES.

Germinating seeds in sawdust.—Germinating seeds in sawdust is not so commonly practiced, we believe, as it might be, owing to the fact that sawdust frequently has a detrimental effect on root growth.

In our intercourse with other teachers of botany we have often been reminded of this fact; and in many instances we have observed the roots of germinating plants grown in this medium to be in a very unhealthy condition.

For the benefit of those who use sawdust in germinating seeds, and have experienced difficulty in obtaining satisfactory results, we offer the following suggestions.

The difficulty lies in the selection of the sawdust. Care should be taken to select sawdust which contains no tannin, as this is the element which causes abnormal root growth. Roots grown in sawdust containing tannin show a reddish coloration, are crooked, and are very much reduced in size. In testing a number of different kinds of sawdust, we have found that that taken from the varieties of oak and chestnut should be avoided, since these woods contain tannin in sufficient quantities to cause the tannin poison. On the other hand, sawdust obtained from the conifers has no detrimental effect whatsoever to root growth.

The sawdust taken from hemlock, which is noted for containing large quantities of tannin in its bark, did not cause the tannin poison; neither did a water solution of the sawdust give a tannin reaction when tested with a solution of molybdate of ammonia in concentrated ammonium chloride. This is due to the fact that the tannin is located in the bark in this species and our sawdust was from heart-wood. That the abnormal appearance of roots grown in chestnut or oak sawdust is caused by tannin can be readily shown by saturating any sawdust suitable for normal growth with a 1 per cent. solution of tannin. If one has an unknown variety, or a mixed sawdust in which the elements are not readily recognized, a water decoction can be prepared and a portion of the same tested for tannin by one or more of the well known tannin tests.

In our opinion, no germinating medium is better than sawdust, as clean straight roots for class study or for experimental purposes can be readily obtained. We have never experienced difficulty with any sawdust which failed to give the tannin reaction, and during the past year we have used the same sawdust continually without changing.

We prefer a rather coarse sawdust to a fine one for general purposes. The seeds should be sown in well drained pots and watered at least once a day. It must not be forgotten, however, that roots germinating in sawdust or even in moist air or water, are slightly different from those grown in earth. The roots of sawdust cultures present characteristics in their growth which are closely allied to roots grown in moist air.—G. E. STONE, *Amherst, Mass.*

Note on the development of a filamentous form of *Protococcus* in entomostracan appendages. (WITH PLATE XXX.)—While examining a collection of *Sphæroplea annulina* brought in during the latter part of April, a very curious object was discovered under the microscope which at first sight might well have been mistaken for a new algal form. It proved to be fragments of the appendages of some entomostracan, presumably a Branchipus, in which a colony of *Protococcus* had obtained a foothold and was apparently in a very thriving condition.

The plant was an aquatic form, the collection having been made from submerged meadow lands. It agreed in every respect with the description given by De Toni of *Protococcus infusionum* (Schrank.) Kirchn., var. *Roemerianum* (Kuetz.) Hansg. The cells were of a bright green color, globose when free and angular in the crowded portions of the mass; the cell membrane was thin and the contents were homogeneous; the average diameter of the cells was about 10μ .

One fragment of the animal appeared to be a part of the antenna, having two long slender sensory hairs each furnished with one row of spines and a single short hair bearing two rows of spines. A second bit was made out to be probably a portion of the gills. Two lobes were each furnished with a row of hairs about $.5\text{mm}$ in length and 17μ in diameter. These hairs were hollow and were very similar in appearance and size to the two long hairs of the antenna. A mass of *Protococcus* had formed in the broad basal portions of the structures and the cells were so numerous that they were crowded and pressed out of the natural form, becoming angular in outline and giving the appearance of a plate or layer of connected cells. Some of the cells had pushed their way up into the hairs, and undergoing division there had almost entirely filled the hollow lower half of each hair. Every hair then contained from one to four oblong masses of cells each mass being the result of the division of a single cell.

The common form of *Protococcus* consists of single cells lying together in a loose mass. Instead of this we here have filaments each composed of several cells. This is apparently brought about simply by the conditions in which the plant finds itself. Individual cells were forced up into the hairs whose walls, being transparent, gave op-